CLAIMS

1. A method for selectively removing inorganic carbon, which may include and/or be convertible to carbon dioxide, from a fluid sample, without significantly impacting the content of total organic carbon components in such sample, prior to analyzing such sample to accurately determine the concentration in the sample of very low levels of total organic carbon, said method comprising the step of bringing said fluid sample into contact with a donor face of a selectively gas-permeable membrane, said membrane having a donor face and an acceptor face and also having a relatively high permeability to carbon dioxide and a relatively low permeability to said total organic carbon components, while establishing an acceptor medium on the other side of the membrane in contact with the acceptor face of said membrane.

2. A method according to claim 1 wherein at least a measurable portion of said total organic carbon content comprises one or more volatile organic compounds.

3. A method according to claim 1 further comprising the step of acidifying said sample to convert inorganic carbon present in the sample as HCO_3^- and/or CO_3^{-2} to carbon dioxide.

4. A method according to claim 1 comprising the step of acidifying the fluid sample to a pH of about 7 or less before it comes into contact with the membrane.

5. A method according to claim 1 comprising the step of acidifying the fluid sample to a pH of about 4 or less before it comes into contact with the membrane.

6. A method according to claim 1 wherein said acceptor medium is selected from the group consisting of: (i) deionized water; (ii) a different portion of fluid sample that has been chemically treated to increase its acceptance of carbon dioxide; (iii) a gas stream having a substantially low content of carbon dioxide; and (iv) at least a partial vacuum.

7. A method according to claim 1 wherein said acceptor medium is deionized water or sample fluid which has been made alkaline, if needed, to a pH of about 8 or greater.

8. A method according to claim 1 further comprising the steps of treating said acceptor medium after it has contacted said membrane to remove or reduce the concentration of said inorganic carbon to restore the acceptor medium to a condition where it is prepared to accept more carbon dioxide, and thereafter recycling said acceptor medium to said acceptor face of said membrane.

9. A method according to claim 8 wherein said acceptor medium is treated by ion exchange.

10. A method according to claim 8 wherein said acceptor medium is treated with gas that is substantially free of carbon dioxide.

11. A method according to claim 1 wherein said membrane is a non-porous membrane.

12. A method according to claim 1 wherein said membrane is selected from the group consisting of: Teflon AF, PFA, and polyfluoropolymer.

13. A method according to claim 1 wherein said membrane is planar in shape.

14. A method according to claim 1 wherein said membrane is tubular in shape.

15. A method according to claim 1 wherein said membrane comprises a planar membrane unit, and further wherein said fluid sample is passed along one face of said membrane while the acceptor medium is established along the other face of said membrane.

16. A method according to claim 1 wherein said membrane comprises a hollow tubular membrane unit, and further wherein said fluid sample is passed through the interior of said tubular membrane unit while the acceptor medium is established in the annular region surrounding the outer wall of said tubular membrane unit.

17. A method according to claim 1 wherein said membrane comprises a hollow tubular membrane unit, and further wherein said acceptor medium is established in the interior of said tubular membrane unit while the fluid sample occupies the annular region surrounding the outer wall of said tubular membrane unit.

18. Apparatus for selectively removing inorganic carbon, which may include and/or be convertible to carbon dioxide, from a fluid sample, without significantly impacting the content of total organic carbon components in such sample, prior to analyzing such sample to accurately determine the concentration in the sample of very low levels of total organic carbon, said apparatus comprising in combination:

(a) a first fluid region for containing a donor fluid, a second region adjacent to said first region for containing or establishing an acceptor medium, said first and second regions

being separated by a selectively gas-permeable membrane having a donor face in said first region and an acceptor face in said second region;

(b) a donor fluid flow control system to control flow of said donor fluid into and out of said first fluid region; and,

(c) an acceptor medium control system to control establishing said acceptor medium in said second region while said donor fluid is in contact with said donor face and for flushing said second region after the acceptor medium has accepted carbon dioxide which has diffused through said membrane.

19. Apparatus according to claim 18 wherein said membrane is planar in shape.

20. Apparatus according to claim 18 wherein said membrane is tubular in shape.

21. Apparatus according to claim 18 wherein said membrane is planar in shape, said first fluid region comprises a region adjacent to one face of said membrane, and said second fluid region comprises a region adjacent to the other face of said membrane.

22. Apparatus according to claim 18 wherein said membrane is tubular in shape, said first fluid region comprises the hollow interior of the tubular space defined by the membrane, and said second region comprises an annular region surrounding said membrane.

23. Apparatus according to claim 18 wherein said membrane is tubular in shape, said second fluid region comprises the hollow interior of the tubular space defined by the membrane, and said first region comprises an annular region surrounding said membrane.

24. Apparatus according to claim 18 wherein said membrane is a non-porous membrane.

25. Apparatus according to claim 18 wherein said membrane is a CO_2-selective membrane that has a relatively high permeability for CO_2 and a relatively low permeability for volatile organic compounds.

26. Apparatus according to claim 18 wherein said membrane is selected from the group consisting of: Teflon AF, PFA, and polyfluoropolymer.

27. Apparatus according to claim 18 further comprising an acceptor medium treatment system for treating said acceptor medium after it has contacted the acceptor face of the membrane to remove or reduce the resulting concentration of inorganic carbon to restore the acceptor medium to a condition where it is prepared to accept more carbon dioxide.

28. Apparatus according to claim 27 wherein said acceptor medium treatment system comprises an ion exchange system.

29. Apparatus according to claim 27 wherein said acceptor medium treatment system comprises a system for treating the acceptor medium with substantially carbon-dioxide-free gas.

30. Apparatus according to claim 27 further comprising an acceptor medium recirculation system for recirculating treated acceptor medium to said second region.

31. Apparatus according to claim 18 further comprising an acidification system for acidifying said donor fluid before it comes into contact with the donor face of said membrane.

32. Apparatus according to claim 18 wherein said first region contains said donor fluid and said second region contains said acceptor medium.

33. Apparatus according to claim 32 wherein said donor fluid has a pH of about 7 or less.

34. Apparatus according to claim 32 wherein said donor fluid has a pH of about 4 or less.

35. Apparatus according to claim 32 wherein said acceptor medium is selected from the group consisting of: (i) deionized water; (ii) a different portion of fluid sample that has been chemically treated to increase its acceptance of carbon dioxide; (iii) a gas stream having substantially no content of carbon dioxide; and (iv) at least a partial vacuum.

36. Apparatus according to claim 32 wherein said donor fluid is an aqueous sample containing inorganic carbon and at least a measurable portion of one or more volatile organic compounds.